Information Technology and Global Value Chains: Growth, Structure and Transformation.

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Abstract

This paper considers the evolution of global value chains in manufacturing and service sectors as driven by new information technologies. The emphasis is on the changes in markets and in process economics created by these technologies rather than the technologies themselves, and on the consequent structural changes in value chains. To analyze the effects of the changes, we examine the impact on demand and supply economics, the economics of transportation and transformation, and the consequences for absolute and comparative advantages for different supply locations. Finally we discuss the global structure of the growing class of value chains that deal with information based products and services. The paper includes a set of abstracted mini-case studies addressing supply and information chains with sourcing from India.

Introduction

It is not that long since the terms "value chain" and "supply chain" began to be used to describe the multi-stage industrial structure underlying manufacturing and service businesses. The terms helped to frame discussions about value addition and profitability as well as the deployment of industrial production across a global arena. The term "chain" also suggested that firms at different stages in an industry might be linked through a variety of mechanisms, and to different degrees, in ways not addressed by the dichotomy presented by traditional vertical integration. Today we should with good cause also talk about "information chains", as the role of pure information based industries, and the information component of other manufacturing and service sectors is being raised in importance by technological advances. We might also note that it would be more accurate to use the word "network" rather than "chain" in almost all our examples, but we will stick with the latter for simplicity.

In this paper we address the evolution of global value chains and the impact of information technologies on these chains. The impact of technologies depends on the nature of the value chain, and there are three major categories that we might consider:

- physical supply chains (dealing with material goods)
- service chains that deal with people and/or materials, and
- information chains that may involve products as well as services.

This is a gross categorization, and actual examples often combine one or more of these types. However, this is a good place to start. Physical supply chains deal with the manufacture and distribution of material goods, ranging from commodities (like steel) to unique items like communications satellites. People oriented services include tourism and transportation. Information chains include software, communications and news. Information chains not only span both products (like books) and services (like data services) but often both (like music distribution); furthermore, they often change from one form to another. Some significant sector examples that involve more than one of these categories are health care (people and information), and book publishing (information and physical). Of course, some of these

examples are changing or will change over time, from one form to another, and this transmutation is part of what we wish to examine here.

In this paper we will focus on (physical) supply chains and information chains, and not people oriented services. This is not to say that the latter sector is unimportant; tourism for example, is a huge global industry, and is growing.

We can take a fairly traditional approach to analyzing our subject. Technological changes can be characterized by their consequences for demand conditions (volume, prices, preferences and new products), market mechanisms (matching, exchanges), industry structure (via entry and transaction costs), and supply (costs, feasibility, advantage). These changes then force corresponding changes in the structure of existing chains, or cause new chains to form. The changes themselves can take place in terms of strategic issues like overall chain structure, or at the operational level in terms of how the chains function.

New Information Technologies and Economic Effects

Information broadcast technologies were well established by the start of the 20th century in the form of radio broadcasting. Television extended the technology to video broadcasts. Interactive telecommunications technologies (telegraph, radio, telephone) were also already well developed long before the latter half of the 20th century. Mobile communications too were available to most institutions if not most individuals. Computers and data processing became widespread after the 1960's, and for the next three decades, information technologies were associated with data processing and computation. Most of the popular excitement surrounding digital technologies in the latter part of this period, was with respect to the decentralization of computing from the mainframe to the desktop. The appearance of the precursors of the Internet (ARPAnet, Bitnet) just prior to the 70's was largely unnoticed by most consumers and firms. Prior to packet switched data networks, computers and telecommunications could be linked only inefficiently through data transfer over voice lines using modems for digital-analog conversion. The invention of the world wide web and the html

document protocol has rapidly shifted attention back from computing to communication and from boxes to wires and pipes. The phenomenon of "ecommerce" has to do primarily with the communications capabilities created by the Internet and the web. The current "hot" topics with respect to digital technologies are wireless communications, broadband and mobility. We cannot discuss these issues in great detail here, but wish to make the point that the focus of attention has gone from communications to computing and now back to communications. It is highly likely that the focus will swing back to computing quite soon, particularly with respect to intelligent systems. Concurrently there have been many technological improvements having to do with methods of information capture (such as scanners and cameras), storage (data bases, storage technology and media) and display (ranging from monitors to copiers, printers and fax machines).

The economic impacts of these technologies are manifold. At the point of information acquisition, the shift from traditional film to digital cameras and scanners, is beginning to reduce the cost of image capture. The more important factor though is that having digitized images greatly reduces the costs of further processing, reproduction and transportation of images. Information processing costs continue to fall dramatically as predicted by Moore's Law, though this progress is sometimes masked by the "bloat" afflicting many common software tools such as word processors. As hardware costs fall, these software costs become more important. As these also fall (due to increased standardization and the low variable costs of software manufacture), the limiting factor for cost and productivity becomes labor cost.

With the advent of optical fiber based communications, the cost of transporting data and information has long been quite small. The actual prices seen by consumers may still seem high, but some of this is artificial, and over time, competition will drive these prices to very low levels. For industrial applications, even high volume streaming video in interactive form, is now economically viable for many applications. For consumers, we are not far from broadband access in the home at reasonable costs.

The costs of receiving, displaying and consuming information are still somewhat high. Here, price reductions will continue to occur, but the pace is somewhat slower. While computing and communications costs have dropped by factors like 100 over the last decade, the costs of display have only reduced by factors of 5 to 10. Still, prices are already low enough to be a non-issue for commercial applications, and are becoming quite low for consumers as well, at least in developed economies. One indication of this is the extremely high level of household penetration of TV's in these economies.

The result is that the cost of end-to-end acquisition, collection, processing, distribution and consumption of information has dropped dramatically and continues to do so. Following the trend forward would suggest that this cost is essentially insignificant for alphanumeric information which does nor require much processing. It may still be significant for a while for dynamic (streaming) video, for very complex computations, and for interactive graphics and video. However, batch transfer of even very large amounts of information (such as a movie) already costs very little, even over global distances.

This underlying reduction in the costs of information logistics (including processing) enables certain structural changes in market mechanisms. One effect is a reduction in the costs of search for buyers. The result, due to either lower costs or improved utility or both, is an upward shifted demand curve. From the sellers' side too, the cost of informing customers about products and services is reduced. The overall effect is better matching of supply and demand in terms of individual (or segments of) buyers and sellers.

A significant effect of reduced logistics costs and better demand-supply matching is to widen the "service area" or market reach of firms, and this process is advancing from the regional to the global level.

An important factor in communication technologies is the convergence to a few open standards for data and information transfer whether at the level of files or interactive sessions. As a result, the transaction costs of moving information across organizational boundaries

continue to reduce. For example, software tools are being developed that can manage work processes across different firms. This has two countervailing effects. First the reduction in transaction costs suggests that decentralization of processes into separate organizations is facilitated. However, standardization can mean that entities whose function lay primarily in transaction and information processing are liable to be disintermediated. Both effects act to create reductions in time and work-in-process or pipeline inventory.

Reduced transaction costs can greatly improve the close coordination of supply, service and information chains, from customers to producers and suppliers. A possible consequence is to make customization or quick response supply and service, much more feasible. Information technologies are also reducing the costs of communication to support strategic aims. In other words, the costs of organizational arrangements, such as contracting, deals and partnering are also potentially reduced.

Physical Supply Chains

Over the past three decades, supply chains for manufactured products have evolved to be highly global in nature. Of course, global trade is hardly new. However, there has been a dramatic difference in the size, character and degree of globalization of supply chains, which has been duly noted in the popular and academic worlds. The driving forces behind these changes are well known; they include

- diffusion of knowledge and technical capabilities
- improved capital availability and accumulation
- reduction of tariffs and trade barriers (trading blocs and partnerships)
- decreases in the relative costs of transportation and logistics
- decreases in communication costs
- on-line information handling and electronic data interchange (EDI)
- improved intelligence about markets

The result has been the emergence of global supply chains connecting low cost manufacturing and supply chain locations with large markets. Unlike historical trade connections, which were usually driven by unique trade goods typically having high value to weight ratios (spices, silk), these new supply chains can involve very mundane items and commodities. Also unlike the colonial structure underlying many historical trade connections, modern supply chains are more directly driven by competitive supply and demand matching (subject to remaining trade barriers and constraints).

Apart from globalization, supply chains have evolved substantially due to technological advances. For example:

• Computer-integrated manufacturing (CIM) and its sub-areas of computer aided design, computer aided manufacturing and computer aided process planning (CAD/CAM/CAPP) have permitted the physical separation of product design, process engineering and production, which were historically co-located. It is possible to capture the production process for a machined part in a program that can be sent as a digital file to a remote location for production from local raw material; this is about as close to teleportation ("beam me up Scotty") as one can get.

• Improved information handling protocols (on-line communications and electronic data interchange - EDI) have greatly improved the efficiency of supply chains, by automating transaction management between firms. These technologies lower the transactions costs of handling information across organizational boundaries.

• New concepts for inter-organizational interaction and coordination, as exemplified by Just-in-time methodologies, have reduced pipeline inventories and delays.

• Supply chain integration has been pursued in many sectors (apparel for example), leading to the replacement of some information and transaction processing intermediaries such as local brokers, agents, forwarders, and sales representatives.

• Aggressive reengineering of supply chains has reduced overall manufacturing costs. For example, a radio board may be “populated” by automation in Canada, then shipped to say Brazil for manual insertion of some components, and then perhaps shipped back to the United States or Mexico for final assembly.

Many of these changes depend on better use of information and of information technologies. However, they all precede wide use of the Internet and the web. At least for high volume manufacturing, the scope for operational improvements of these supply chains would seem to very limited. Certainly, replacing EDI with web-based transaction management is helpful, particularly for smaller suppliers. However, the impact is not huge.

The most significant impacts of technology change on physical supply chains are likely to arise from changes in market mechanisms and market dynamics, caused by improved demand and supply matching due to lower costs of establishing a presence through the web, and lower costs of searching for buyers. There are several kinds and degrees of change that are possible. At the simplest level, suppliers can put their catalogs on the web in electronic form and can take orders on-line. At the next level, simple contracting and price negotiation can be carried out over the web. A subsequent step is the appearance of new intermediaries who provide information about capacity and capability, and provide search tools. Next is the appearance of aggregators (on either the demand or supply side) who provide benefits through the creation of scale through aggregation, which in turn confers increased markekt power. The next level of evolution is the appearance of new market mechanisms such as auctions and exchanges, that operate more efficiently and on a larger (global) scale. Among the many results can be:

- lower costs of entry and of contracting with buyers. This is likely to favor smaller suppliers.
- more intense competition among suppliers.
- higher degree of integration due to low cost communications.
- disintermediation of stages which primarily involve information and transaction handling (rather than actual physical handling).

Information Chains

The nature of information based industries and information chains is quite different from physical supply chains. Generally speaking, the linguistic and cultural factors inherent in information, have tended to create localization and regionalization of information markets. To some extent, some physical goods also have this characteristic. For example, household goods can vary substantially across regions, and what is normal in one locality may be a curiosity in

another. Nevertheless, many physical goods retain their functionality and usefulness in all localities, possibly with minor design changes to account for some local factors. Information markets are more diverse and more specialized or customized. However, where information is in packaged form, it has been easier to address global markets; examples include music, books and packaged software. It has also been possible to develop global markets, in sectors where linguistic and cultural factors are not that significant; technical publishing, and industrial services (e.g construction of large civil and engineering projects) are examples.

The impact of new information technologies on information chains is as substantial globally as it has been within nations. Ecommerce, which might be thought of as facilitating searching and matching of vendors and buyers, is certainly significant, although physical distances and tariff barriers make it less significant for retailing physical products where physical logistics costs become the limiting factor.

The real impact of information technologies is being felt in terms of the globalization of information services. There are multiple reasons for this. The ones that apply in the physical case also apply here; these include improvements in searching by buyers, and matching buyers to sellers. However, certain other factors are specific to information products that are not packaged in physical form, and information services.

One of the most important is the cost of transportation, distribution and delivery. This cost has been reduced substantially by the existence of the Internet and the web. As yet, the actual costs of transportation are not always low, since they require the use of telecommunications, where the price is often artificially high. However, these costs are dropping, and the real cost of transportation is quite low, due to substantial existing capacity through global fiber and satellite networks. Even where inter-regional costs of information logistics are high, the costs within market areas (the US in particular) are often quite low. Furthermore, the transaction costs of moving information from firms to the transportation medium (telecommunications) and back to a firm, have been reduced by use of the web and browser interfaces.

New file formats and protocols (such as MP3 for music), coupled with low cost readers and players have made it possible to shift distribution of some forms of information products away from packaged formats, to on-line formats.

As the relative costs of hardware and software have dropped, labor has become the limiting factor for production of many information products and services. The result is that low labor cost locations now have an absolute advantage in the total costs of producing many information products. Furthermore, since the costs of entry are also weighted towards labor, entry actually becomes easier for low labor cost locations. Thus, for example, the initial cost of producing the first release of a software package, might be three times more in a US location that for an Indian location.

As a consequence, in the last three decades, there has been a large increase in the provision of information services from sources in the East. The early examples were typically keyed data entry. A typical example would be the conversion of traffic tickets from handwritten to punched card form. The nature of services provided has become more and more sophisticated over the years. Today, a wide range of information services is out-sourced often to off-shore locations, including:

- transcription of handwritten and voice data (e.g. doctors' notes)
- creation of animation
- data structuring and editing (technical data processing)
- management of accounting information
- on-line email response
- customer response by voice and email
- technical support services (e.g. medical equipment)
- software maintenance
- website maintenance

Current trends suggest that the services that are provided will shift towards higher levels of technical and specialized knowledge. Some areas that are being addressed today include

- teaching and tutoring
- engineering services
- graphics and graphic design
- editing and publishing services
- legal data, information and support services
- customer service management
- medical diagnosis and advice
- research (analytical and clinical)
- consulting and business development services

Some of these are in the early stages of development, others are already fairly well established.

The Geographical Structure of Chains

The global nature of physical supply chains has historically depended first on unique products, then on patterns of colonial expansion, and most recently on cost and quality advantages. At the last stage, supply chain structures does not need to change very fast, since cost structures cannot change that quickly. The high costs of physical infrastructure specialized to particular chains, also means that there are some naturally advantageous geographical forms, and that changing form is difficult. For example, seaports represent important nodes in supply chain structure, since they provide the point of transition between land based and water based transportation modes. It is fairly easy to understand why Singapore, Rotterdam, Shanghai and Los Angeles/Long Beach are significant ports, but also why ports such as Genoa have declined (and why Hong Kong or Bremen may suffer similarly).

In the case of information chains, physical infrastructure does not play as great a role. There are no geographically determined bottlenecks, like ports, or indeed significant physical barriers of any kind, given the feasibility of satellite communications. The costs of the information infrastructure are primarily fixed (as distinct from the physical case). Furthermore, regions with large populations are likely to develop such an infrastructure over time. Since

information production as well as consumption is likely to scale with population, infrastructure will correlate with productive capacity quite quickly.

Despite the underlying network character of communication and distributed processing systems, the information infrastructure seems to the user, and is for practical purposes, amorphous. It is also only weakly regional in the physical sense. While there may indeed be differences in cost and response times across different regions, these differences only apply to certain categories of use, are reducing over time, and are only weakly correlated to geography.

It might then be reasonably conjectured that given the smaller scale of information production facilities, there might be no particular pattern to the supply sites for information products and services. However, we see that there are indeed very significant regional and global patterns to information chains. For example, there are very often very specific locations that dominate the production of certain kinds of information products; sometimes a single firm may be involved. Well known examples from the software domain are Bangalore in India, Provo and Orem in Utah, and Seattle. This clustering pattern is also very visible in the case of manufactured goods, and the phenomenon has been thoroughly discussed elsewhere.

More broadly, the US dominates the production of packaged software (operating systems, browsers, application programs). This sector has a clear correlation with a similar domination of the computer and communications hardware sector, at the level of final products. This correlation may start to dissipate in the future as hardware products become smaller, and manufacturing effectiveness becomes more significant. This will tip the balance on the hardware side to manufacturers in the Far East, but the impact on software will be slow to occur. This is because information products require a high degree of interactivity with the user, and familiarity with the user is an important factor in determining product success. One might predict that in cases where the software is not visible to the consumer or user (e.g. imbedded applications) there may indeed be a shift towards hardware producers.

India is emerging as a global leader in information services and custom software (as distinct from packaged products). The driving forces behind this are the low cost of labor and the familiarity with the English language (which is a consequence of colonial history). India is in an almost unique position with respect to these two attributes. The other contenders are the islands of the West Indies, Pakistan, Sri Lanka, the Philippines and perhaps Bangladesh. India is by far the largest of these and has a somewhat stronger technological position than the others. It appears to be on a course to be the primary location for provision of information services to the US market. It is also likely to be a primary supplier to Europe, although it may not occupy that role to the same degree

We are still at the early stages of full development of the global spread of information markets and information chains. The structure of the global market is not yet apparent. However, we would suggest that the topography of information chains will be more determined by metrics related to similarity in language, culture and communication than is the case for physical supply chains. There, we pointed to the roles of unique commodities, followed by a colonial heritage and then low cost production and distribution. The colonial heritage has a role in the information sector because of language, but not always because of political or economic connections. Just for example, it is notable that U.K. companies have been unable to leverage their colonial history (in India or elsewhere) to create economic partnerships. Instead, we are beginning to see a distinct partnership emerge between the US and India that is built partially upon the linguistic legacy of colonial history. However, it is equally built upon the relative openness of US immigration policies, and the meritocracy in the US business system.

To summarize, information (and knowledge) supply networks are likely to form loose grouping based on language, culture and immigration patterns (which are a reverse form of colonialism). A US market driven supplier block for information services could include Bangladesh, Hong Kong, Israel, India, Philippines, Singapore. The market for services to Japan may well be dominated by China (PRC). Germany might be supported by East European countries (Czechoslovakia, Poland), though there are signs that there some interest in

partnering with Indian firms there as well. A company supporting French markets is considering sources like Tunisia, Morocco and Mauritius.

Effects on Regional Development: the case of India

The growth of information technology related exports from India has led to several very interesting consequences. Although India is a very undeveloped economy by most measures, the information services sector is at world class levels. Some of the best performing Indian companies in terms of stock valuations are in the information sector (e.g. Infosys, Wipro), and the valuations of these companies are as optimistic as any in the US.

Initially, Bangalore was quickly identified as the "Silicon Valley" of India, due to the presence of major foreign (e.g. Texas Instruments) and Indian (e.g. Wipro) companies. However, Mumbai (Bombay), Delhi and Chennai (Madras) have followed suit, and many other cities and states are targeting the development of software and information services as a significant area. Pune is already a strong contender due to the presence of many colleges and universities, as well as a leading public institution that trains software engineers (CDAC). Hyderabad has managed to make an exceptionally fast start in this direction is being cited as an example of progressive political action. The presence of major universities, engineering colleges and technical schools is a key factor in creating such centers. It is likely that many cities will try and follow this path when they have the wherewithal to do so. One of the very heartening factors about this type of regional development, is that it is not dependent on any particular physical endowment. There are obvious advantages for large metropolitan areas, but as the experience in the rest of the world shows, relatively isolated, small centers can do very well. The implication is that regional development could be very widely spread, in contradistinction to manufacturing, which is usually dependent on many local factors and supporting infrastructure.

The impact of the software industry on economic development should not be overestimated. Entry into this industry requires high levels of education, and it does not create employment for the large mass of Indians. What is more, unlike manufacturing industries, there is a very low level of demand for infrastructure and supporting industry. Most of the

technologically crucial physical assets are imported. The information chain, unlike supply chains, is rather shallow, and there is not the same multiplier effect that is created by multiple manufacturing stages. Manufacturing development tends to be accompanied by spin-offs that start to serve local markets with low-end products and local variants of exported goods. This does not seem to transfer to software, particularly since much of the Indian software industry is oriented towards subcontracting of capacity (so-called "body shopping"), custom projects, and imbedded (rather than consumer) software. Thus while there has been substantial wealth creation at the level of individuals, the total magnitude of exports is still quite small in relation to the total population, and it is hard to imagine it rising to high levels on a per capita basis. It could be said that the software industry makes the technically educated middle class rich, but it will not do very much for the larger population.

Having said that, there is the interesting possibility that the software exporting industry could catalyze development in the manufacturing sector. At present, many large Indian business houses are working hard to enter the information technology sector. In the past, most of these firms have been content to maintain manufacturing and service operations in India, and enjoy the profitability of the protected, government controlled nature of the Indian market. However, deregulation is moving forward in some part due to the experience of the software sector, albeit in fits and starts. Furthermore, entry into the software sector is leading old-line firms to become aware that they also have opportunities for export in their traditional manufacturing lines of business. It is also clear that with the gradual opening of the economy, they need to develop their manufacturing capabilities to world class levels. The basic fact is that on labor cost and technical capability, India has the capacity to become as successful in manufacturing as any of its Asian neighbors. We predict that the software industry will be the catalyst for developing an active global role for Indian manufacturing capabilities, which till now have been invisible on the world market.

Summary

We have examined the nature of physical and information supply chain operation and structure with respect to the effect of new information technologies. The main conclusions we reach are the following:

- In physical supply chains, the primary effect of ecommerce will be through improved search and matching through web based markets. The effects on inventories, coordination and organizational efficiency will be significant, but more parametric than revolutionary.
- Closer partnering relationships, and increased entry and competition at all stages are likely in supply as well as information chains.
- One of the effects of ecommerce on regional supply chains, is to reduce physical capacity at the retail end of the chain. Essentially, local inventories are substituted by on-line ordering, with fulfillment from a different location. On a global level, this is less of a factor, because the distances involved make small shipments uneconomical.
- Information chains are changing radically, as new technologies drastically alter the economics of production and distribution of information.
- The economics of information production are being dominated by low labor costs as hardware and software costs drop (relatively). This strongly affects the geography of information chains.
- Information chains are evolving to address knowledge based areas including professional fields such as law, medicine, education, engineering, accounting and finance.
- The global topology of information chains is being driven by both cost as well as linguistic and cultural factors. To some extent these factors have to do with colonial histories.
- On the whole, it appears that trade in information goods and services may not have as large an impact on regional economic development as trade in manufactured goods. However, it appears that the information sector may act as a catalyst for growth in the manufacturing sector, through business relationships.

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Appendix: Case Examples

A. Company A is an apparel retailer that operates an integrated supply chain from suppliers in India to warehousing in the US. The suppliers in India are investors and partners in the US enterprise. Inventory in the US warehouse is very low (2-4 weeks max) and is replenished by air freight from India. The suppliers use small lot production to be able to respond quickly to mix and volume variations. Sales in the US are through a web site, and through "agents". Integration of the supply chain to India and the manufacturing network in India is done through a "digital backbone" which is a relatively low tech mix of web, fax and phone communications.

B. Company B is a specialty chemicals marketing company with sales in the US and Europe. Production is done through small manufacturers in India, who do not have the wherewithal to build marketing organizations. Company B has an exclusive relationship with a firm in India that

does no production, but acts to develop and manage the production network, including test sample creation, new technology transfer, quality control and shipping out of India. The key communication channel is between Company B and its Indian ally. The two firms have strong personal connections, but no cross-equity holding or other form of business arrangement. The firm sees web based exchanges as a serious threat. It is attempting to form relationships between suppliers and buyers, in which it plays an important value-adding role in developing the capabilities of suppliers to meet buyer needs.

C. Company C is a US startup specializing in Customer Relationship Management (CRM). Company C maintains a marketing, sales and consulting arm in the US, and has software development and service operations in Bangalore, India. The Bangalore subsidiary handles integration of software packages to deliver complete solutions to US clients. It also provides other labor intensive services such as email response, chat lines and hot-line support for customers. The company is contemplating addressing European markets. The first target with be the English block which includes Scandinavian countries. The second will be France, in alliance with a French partner. Here the firm is considering creating support operations in Morocco, Tunisia or Mauritius.

D. Company D is an Indian startup funded by US venture capital and by a major Indian house. It provides email response support for customers of US firms, which are its clients. Company D depends on consulting firms in the US as channels to its client markets.

E. Company E is a startup venture in the US, which follows a model similar to company B but for software services. Rather than a partner, it has a subsidiary in India that has in-house capacity and also manages a network of software developers and service providers. The services include content editing, graphics and design work. The company intends to provide a complete service to create and maintain web based solutions for all kinds of functional requirements. Initial projects include web applications for an apparel retailer, a consulting firm, a web education firm, and a web based publisher.

F. Company F is an Indian company which has been selling packaged and customer software in India for many years. It is now attempting to address the US market for its web based ERP and ecommerce products. It is evaluating the options of partnering with a US software firm, developing channel relationships, or obtaining funding in India to establish its own marketing arm in the US. Essentially the change in enterprise systems created by the web is creating an opportunity for this firm that it never had previously.

G. Company G is developing software for professional applications including statistics and optimization packages. The core algorithms were purchased from European and Australian companies who were unable to commercialize them due to high fixed costs. Company G is using Indian developers to finish the products, which effectively lowers the fixed costs of entry. The company is considering partnering with a very large leading software developer in India. The latter on its part has been predominantly a custom software producer, and now sees an opportunity to enter the packaged software market.

H. Company H (as yet unincorporated) is entering the market for legal support services, to be based in India. It has identified several niche markets which are not served by the existing very large legal publishers in the US. Funding for the venture is likely to be provided by Indian capital sources.

I. Company I (as yet unincorporated) is entering the market for homework assistance and mathematics and science tutoring, with teachers based in India.

J. Company J (as yet unincorporated) is entering the market for graphics design services and digital assets, to be provided by a factory in India. There are already some sizeable firms providing animation and other video and graphics services from India (e.g Pentafour, ViewPoint). This company is targeting somewhat different markets.